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(54) SCHEDULING TYPE DEAD CHANNEL CONTROL ACCESS METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a dead channel control access method in which data are transferred continuously in the case of conducting packet communication and the degree of occupancy of a backward channel is decreased.

SOLUTION: In the case of conducting packet communication, packet terminal equipments 2, 3

send a reservation signal through an optional incoming slot among slots receiving a dead channel signal from a radio base station 1. The radio base station 1 switches the dead channel signal to an inhibit signal to inhibit transmission from the other packet terminal equipment and provides a transmission permission to instruct a transmission enabling timing (1) to the packet terminal equipment 2 and provides the transmission permission to instruct a transmission enabling timing (7). Thus, the packet terminal equipment 2 starts transmission of a packet group from a 1st incoming slot after receiving the enabling signal and the packet terminal equipment 3 starts transmission of a packet group form a 7th incoming slot after receiving the enabling signal.

CLAIMS

[Claim(s)]

[Claim 1]Wireless packet communication is performed using common packet channels between a base transceiver station and two or more packet mode terminals of this base transceiver station subordinate, An inhibiting signal which shows that take a frame structure which a radio channel between said base transceiver station and said packet mode terminal is slot-ized, and makes one frame n slot (n: natural number), and said packet channels are using said base transceiver station, In the state where, as for said each packet mode terminal which has a means to report a free line signal which shows that it is idle status, and is newly going to transmit a packet, said free line signal is reported, First, transmit a reservation signal to said base transceiver station, and after receiving an enabling signal which subsequently grants a transmission right from said base transceiver station to the packet mode terminal concerned, following packet transmission is started, In a free line control access method of performing information of said inhibiting signal and forbidding access from other packet mode terminals while said base transceiver station has received a packet from the packet mode terminal concerned, By two or more slots in one frame, said packet channels have multi-slots composition which uses two or more slots within one frame, and said reservation signal is ability ready for sending, and said packet mode terminal, a packet which is going to transmit beforehand -- the singular number -- or more than one being collected, and the 1st packet group being generated, and, Choose arbitrary slots out of a going-up slot in one corresponding to a slot which received said free line signal, and said reservation signal is transmitted, When the length of said 1st packet group is given to said reservation signal as Request-to-Send length and said base transceiver station receives the singular number or said two or more reservation signals within one frame, As opposed to the singular number which transmitted said reservation signal, or said two or more packet mode terminals, Transmit said enabling signal which gave respectively individual transmission permission timing, and a period of the total of said Request-to-Send length within the singular number or said two or more reservation signals is made into a reservation period, Continue transmitting said inhibiting signal, and said packet mode terminal transmits with said transmission permission timing of a local station directed within said enabling signal one by one as the starting point, and said 1st packet group said base transceiver station, A scheduling type free line control access method characterized by changing said inhibiting signal to said free line signal after said reservation period expires.

[Claim 2]In the scheduling type free line control access method according to claim 1, said packet mode terminal, When there is the 2nd packet group that transmits following the transmission

back of said 1st packet group, In a packet signal of said 1st packet group, an additional Request to Send of said 2nd packet group is performed, The length of said 2nd packet group to add is given as said Request-to-Send length, When not giving an additional transmission permission to said 2nd packet group, after said reservation period expires, said base transceiver station, Under conditions which change said inhibiting signal to said free line signal, and give an additional transmission permission, and in during said reservation period, Give said transmission permission timing to said enabling signal, transmit to the packet mode terminal concerned, and the length of said 2nd packet group is added at said reservation period, Continue transmission of said inhibiting signal and said packet mode terminal starts transmission of said 2nd packet group with said transmission permission timing as the starting point within said enabling signal, When said inhibiting signal is changed to said free line signal, and an additional transmission permission is given and said reservation signal or said additional Request to Send is not received to others under conditions which are not said reservation period Naka after said reservation period expires, said base transceiver station, Give said transmission permission timing to said enabling signal, transmit to the packet mode terminal concerned, and the length of said 2nd packet group is made into said reservation period, Continue transmitting said inhibiting signal, and said packet mode terminal begins with said transmission permission timing as the starting point within said enabling signal, and transmission of said 2nd packet group said base transceiver station, After said reservation period expires, said inhibiting signal is changed to said free line signal, When an additional transmission permission is given and said reservation signal or said additional Request to Send is received to others under conditions which are not said reservation period Naka, Said enabling signal which gave said transmission permission each of said packet mode terminal timing set up individually, respectively is transmitted, A period of the total of the length of said 1st packet group within said reservation signal and the length of said 2nd packet group in said additional Request to Send is made into a reservation period, Continue transmitting said inhibiting signal and said each packet mode terminal starts transmission of said 1st packet group or the 2nd packet group one by one with said transmission permission timing as the starting point within said enabling signal, A scheduling type free line control access method after said base transceiver station expires [said reservation period], wherein it changes said inhibiting signal to said free line signal.

[Claim 3]In a scheduling type free line control access method according to claim 1, Said base transceiver station compares the length of said 1st packet group within said each reservation signal, when two or more reservation signals are received within one frame, A scheduling type

free line control access method setting up said transmission permission timing give priority over said packet mode terminal with the short length of said 1st packet group, and give a transmission permission.

[Claim 4]In a scheduling type free line control access method according to claim 2, When said base transceiver station receives the singular number or said two or more reservation signals, and said additional Request to Send within one frame, A scheduling type free line control access method setting up said transmission permission timing give priority over said packet mode terminal which transmitted said reservation signal, and give a transmission permission from said packet mode terminal which transmitted said additional Request to Send.

[Claim 5]In a scheduling type free line control access method according to claim 2, When said base transceiver station receives two or more said reservation signals and said additional Requests to Send within one frame, Priority is given to said packet mode terminal which transmitted said reservation signal over said packet mode terminal which transmitted said additional Request to Send, And a scheduling type free line control access method setting up said transmission permission timing compare the length of said 1st packet group within said each reservation signal, give priority to said packet mode terminal with the short length of said 1st packet group, and give a transmission permission.

[Claim 6]In a scheduling type free line control access method given in either of claim 1 or 3, A scheduling type free line control access method of suspending change during said reservation period and making a change after the end of said reservation period when said base transceiver station needs to change a slot number currently used for said packet channels.

[Claim 7]In a scheduling type free line control access method given in either of claim 2, 4, or 5, A scheduling type free line control access method of making a change after the end of said reservation period without permitting transmission when said base transceiver station needs to change a slot number currently used for said packet channels, change is suspended during said reservation period and said additional Request to Send is received.

2.**** shows the word which can not be translated.

3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to the free line control access method used for a wireless data communication system.

[0002]

[Description of the Prior Art]

(Conventional technology 1:ICMA-PE) ICMA-PE (Idle-signal Casting.) adopted with the digital car and the portable telephone system (PDC method (PersonalDigital Cellular)) A Multiple Accesswith Partial Echo method, 3 multiplex TDMA-FDD (Time Division Multiple Access-Frequency Division Duplex) The method extended to multi-slots correspondence of a method is proposed.

[0003]The example of the method mentioned above of operation is shown in drawing 16. As shown in the figure, packet channels comprise multi slots which use three slots simultaneously. A base transceiver station reports a free line signal, when packet channels are idle status. Packet mode terminal A is in the singular number or the state where collect more than one, generate the 1st packet group, and the free line signal is reported, about the packet which is going to transmit beforehand, and in order to reserve packet channels, it transmits only a part for one packet of the head of a packet group.

[0004]The slot number corresponding to the slot number which received the packet signal gets down, and it is a slot, and a base transceiver station transmits a part of inhibiting signal and

received packet signal as a partialness echo, grants a transmission right to the packet mode terminal concerned, and starts transmission of a reservation signal. Thereby, packet mode terminal A transmits the packet signal which follows with the going-up slot of the slot number corresponding to the slot number which received the partialness echo as the starting point by the multi slots which use two or more slots simultaneously.

[0005]If packet mode terminal B which transmitted a part for one packet of the head of a packet group after packet mode terminal A receives the reservation signal mentioned above in order to reserve packet channels, when there is a packet signal which follows, it will move to a resending state. There is no concept of an additional Request to Send in this method. (Refer to issue in 520 or Wada, Maebara, Okajima, Umeda, "application to PDC packet communication of ICMA/PE", collection [of the 1995 Institute of Electronics, Information and Communication Engineers synthesis convention drafts], and B-1995)

[0006](Conventional technology 2:ICMA-BR) The ICMA-BR (Idle-signal Casting Multiple Access with Block Reservation) method which sets up a reservation period using a reservation signal and an enabling signal is proposed. The example of operation at the time of applying this method to a TDD (Time Division Duplex) method is shown in drawing 17. As shown in the figure, a base transceiver station reports a free line signal, when packet channels are idle status. More than one are collected, the 1st packet group is generated, and a packet mode terminal transmits a reservation signal for the packet which is going to transmit beforehand in the singular number or the state where the free line signal is reported, and gives the length of the 1st packet group to the reservation signal as Request-to-Send length.

[0007]On the other hand, if the reservation signal mentioned above is received, a base transceiver station transmits an enabling signal to the packet mode terminal concerned, will grant a transmission right to the packet mode terminal concerned, and will transmit an inhibiting signal by making Request-to-Send length into a reservation period. And a packet mode terminal transmits the 1st packet group after enabling signal reception, and a base transceiver station changes the inhibiting signal mentioned above after the reservation period expired to a free line signal.

[0008]When there is the 2nd packet group that transmits following the transmission back of the 1st packet group, in the packet signal of the last of the 1st packet group, a packet mode terminal performs the additional Request to Send of the 2nd packet group, and gives the length of the 2nd packet group to add as Request-to-Send length in that case. On the other hand, about the 2nd packet group, a base transceiver station transmits a free line signal, when not giving an

additional transmission permission, when giving an additional transmission permission, it transmits an enabling signal to the packet mode terminal concerned, it adds a part for additional Request-to-Send length at the reservation period mentioned above, and continues transmitting an inhibiting signal. And a packet mode terminal transmits the 2nd packet group after enabling signal reception, and a base transceiver station changes an inhibiting signal to a free line signal, after the above-mentioned reservation period expires. (Refer to issue in 494 or Kayama, "proposal of block request-to-print-out-files free line control system in PHS radio packet", collection [of the 1996 Institute of Electronics, Information and Communication Engineers synthesis convention drafts], and B-1996)

[0009]

[Problem(s) to be Solved by the Invention]By the way, in the method of the conventional technology 1, when a base transceiver station receives the packet signal from two or more packet mode terminals within one frame, a transmission permission is given only to one packet mode terminal. For this reason, although the packet mode terminal in which the transmission permission was given can transmit a following packet signal, other packet mode terminals need to be resent and need to require a request to print out files by random access again. For this reason, while the delay for resending arises, at the time of random access, it may collide with the packet signal from other packet mode terminals, and decline in channel efficiency and the increase in a time delay are caused.

[0010]Since the method of the conventional technology 1 does not have a means which carries out additional transmission, the packet mode terminal needs to require a request to print out files by random access again, even when there is the 2nd packet group that transmits following the transmission back of the 1st packet group. For this reason, it may collide with the packet signal from other packet mode terminals at the time of random access, and the increase in a time delay is caused by decline in channel utilization efficiency, and resending at the time of a collision. The timing at the time of changing the number of multi slots of packet channels is not described.

[0011]Also when the method of the conventional technology 2 is applied to the access method of the packet channels of the multi-slots composition which can transmit two or more reservation signals within one frame, Like the conventional technology 1, when a base transceiver station receives the reservation signal from two or more packet mode terminals within one frame, a transmission permission is given only to one packet mode terminal, but other packet mode terminals need to be resent and need to require a request to print out files by random access again. For this reason, while the delay for resending arises, at the time of random access, it may

collide with the reservation signal from other packet mode terminals, and decline in channel utilization efficiency and the increase in a time delay are caused.

[0012]When the reservation signal from other packet mode terminals is received at the time of an additional Request to Send, a transmission permission is given to the packet mode terminal which transmitted the additional Request to Send, but other packet mode terminals need to be resent and need to require a request to print out files by random access again. For this reason, while the delay for resending arises, it may collide with the reservation signal from other packet mode terminals at the time of random access, and decline in channel utilization efficiency and the increase in a time delay are caused. The timing at the time of changing the number of multi slots of packet channels is not described.

[0013]Then, when this invention receives the reservation signal from two or more packet mode terminals within one frame to the 1st, When a base transceiver station adjusts transmission permission timing and directs to each packet mode terminal individually, it aims at providing the scheduling type free line control access method which has high channel utilization efficiency, and few time delays.

[0014]When an additional Request to Send and a reservation signal are received within one frame to the 2nd, When a base transceiver station adjusts transmission permission timing and directs to each packet mode terminal individually, it aims at providing the scheduling type free line control access method which has high channel utilization efficiency, and few time delays. It aims at providing the 3rd with the scheduling type free line control access method which can be changed dynamically for the number of multi slots.

[0015]

[Means for Solving the Problem]In order to solve the above-mentioned technical problem, the invention according to claim 1, Wireless packet communication is performed using common packet channels between a base transceiver station and two or more packet mode terminals of this base transceiver station subordinate, An inhibiting signal which shows that take a frame structure which a radio channel between said base transceiver station and said packet mode terminal is slot-ized, and makes one frame n slot (n: natural number), and said packet channels are using said base transceiver station, In the state where, as for said each packet mode terminal which has a means to report a free line signal which shows that it is idle status, and is newly going to transmit a packet, said free line signal is reported, Transmit a reservation signal to said base transceiver station first, and after receiving an enabling signal which subsequently grants a transmission right from said base transceiver station to the packet mode terminal concerned,

following packet transmission is started, In a free line control access method of performing information of said inhibiting signal and forbidding access from other packet mode terminals while said base transceiver station has received a packet from the packet mode terminal concerned, By two or more slots in one frame, said packet channels have multi-slots composition which uses two or more slots within one frame, and said reservation signal is ability ready for sending, and said packet mode terminal, a packet which is going to transmit beforehand -- the singular number -- or more than one being collected, and the 1st packet group being generated, and, Choose arbitrary slots out of a going-up slot in one corresponding to a slot which received said free line signal, and said reservation signal is transmitted, When the length of said 1st packet group is given to said reservation signal as Request-to-Send length and said base transceiver station receives the singular number or said two or more reservation signals within one frame, As opposed to the singular number which transmitted said reservation signal, or said two or more packet mode terminals, Transmit said enabling signal which gave respectively individual transmission permission timing, and a period of the total of said Request-to-Send length within the singular number or said two or more reservation signals is made into a reservation period, Continue transmitting said inhibiting signal, and said packet mode terminal transmits with said transmission permission timing of a local station directed within said enabling signal one by one as the starting point, and said 1st packet group said base transceiver station, After said reservation period expires, it is characterized by changing said inhibiting signal to said free line signal.

[0016]In the scheduling type free line control access method according to claim 1, the invention according to claim 2 said packet mode terminal, When there is the 2nd packet group that transmits following the transmission back of said 1st packet group, In a packet signal of said 1st packet group, an additional Request to Send of said 2nd packet group is performed, The length of said 2nd packet group to add is given as said Request-to-Send length, When not giving an additional transmission permission to said 2nd packet group, said base transceiver station After said end of request-to-print-out-files ****, Under conditions which change said inhibiting signal to said free line signal, transmit, and give an additional transmission permission, and in during said reservation period, Give said transmission permission timing to said enabling signal, transmit to the packet mode terminal concerned, and the length of said 2nd packet group is added at said reservation period, Continue transmission of said inhibiting signal and said packet mode terminal starts transmission of said 2nd packet group with said transmission permission timing as the starting point within said enabling signal, When said inhibiting signal is changed

to said free line signal, and an additional transmission permission is given and said reservation signal or said additional Request to Send is not received to others under conditions which are not said reservation period Naka after said reservation period expires, said base transceiver station, Give transmission permission timing to said enabling signal, transmit to the packet mode terminal concerned, and the length of said 2nd packet group is made into said reservation period, Continue transmitting said inhibiting signal, and said packet mode terminal begins with said transmission permission timing as the starting point within said enabling signal, and transmission of said 2nd packet group said base transceiver station, After said reservation period expires, said inhibiting signal is changed to said free line signal, When an additional transmission permission is given and said reservation signal or said additional Request to Send is received to others under conditions which are not said reservation period Naka, Said enabling signal which gave said transmission permission each of said packet mode terminal timing set up individually, respectively is transmitted, A period of the total of the length of said 1st packet group within said reservation signal and the length of said 2nd packet of ****** in an additional **** demand is made into a reservation period, Continue transmitting said inhibiting signal and said each packet mode terminal starts transmission of said 1st packet group or the 2nd packet group with said transmission permission timing as the starting point within said enabling signal, Said base transceiver station is characterized by changing said inhibiting signal to said free line signal, after said reservation period expires.

[0017]In a scheduling type free line control access method according to claim 1 the invention according to claim 3, It is characterized by said base transceiver station setting up said transmission permission timing compare the length of said 1st packet group within said each reservation signal, give priority over said packet mode terminal with the short length of said 1st packet group, and give a transmission permission when two or more reservation signals are received within one frame.

[0018]In a scheduling type free line control access method according to claim 2 the invention according to claim 4, When said base transceiver station receives the singular number or said two or more reservation signals, and said additional Request to Send within one frame, It is characterized by setting up said transmission permission timing give priority over said packet mode terminal which transmitted said reservation signal, and give a transmission permission from said packet mode terminal which transmitted said additional Request to Send.

[0019]In a scheduling type free line control access method according to claim 2 the invention according to claim 5, When said base transceiver station receives two or more said reservation

signals and said additional Requests to Send within one frame, Priority is given to said packet mode terminal which transmitted said reservation signal over said packet mode terminal which transmitted said additional Request to Send, And it is characterized by setting up said transmission permission timing compare the length of said 1st packet group within said each reservation signal, give priority to said packet mode terminal with the short length of said 1st packet group, and give a transmission permission.

[0020]In a scheduling type free line control access method given in either of claim 1 or 3 the invention according to claim 6, When said base transceiver station needs to change a slot number currently used for said packet channels, it is characterized by suspending change during said reservation period and making a change after the end of said reservation period.

[0021]In a scheduling type free line control access method given in either of claim 2, 4, or 5 the invention according to claim 7, When said base transceiver station needs to change a slot number currently used for said packet channels, change is suspended during said reservation period and said additional Request to Send is received, it is characterized by making a change after the end of said reservation period, without permitting transmission.

[0022]

[Embodiment of the Invention]Hereafter, each embodiment of this invention is described with reference to drawings. Before that, the composition of the wireless packet communication in each embodiment is shown in drawing 1. As shown in the figure, the one base transceiver station 1 has accommodated the packet mode terminals 2-4 which perform packet communication, and the line switching terminal 5 which performs line switching communication.

[0023]The radio channel between a base transceiver station and each terminal is constituted by the 4 multiplex TDMA-TDD system. And transmission of the data packet between the base transceiver station 1 and the packet mode terminals 2-4 is performed using packet multiplexing on common packet channels. The transmitter-receiver which the base transceiver station 1 has is made only into one set, and when a circuit-switched call occurs, it communicates by the base transceiver station 1 assigning one of the TDMA slots to the circuit-switched call for exclusive use.

[0024]Next, the operation outline in each embodiment of this invention is explained using a time chart and an operation flow.

[A 1st embodiment] The example (it corresponds to claim 1) of the scheduling type free line control access method in a 1st embodiment of operation is shown in drawing 2. In the figure, the upper row shows transmission and the input signal of the base transceiver station 1, and is

expressed with the rectangle corresponding to the slot of the radio channel, respectively. The middle shows the occurrence patterns of the transmitting packet of the packet mode terminal 2, and the lower berth shows the occurrence patterns of the transmitting packet of the packet mode terminal 3.

[0025]In this figure, packet channels show the case where it is set up using four slots simultaneously. The case where decompose PDU (Protocol Data Unit) of the upper layer into a radio slot, and it transmits is assumed, The unit transmitted by one decomposed slot was defined as one packet, and PDU of the upper layer is defined as a packet group which combined two or more packets.

[0026]The packet mode terminal 2 which the packet group which should transmit generated transmits a reservation signal by arbitrary going-up slots out of the slot which received the free line signal. Here, a reservation signal contains the terminal identifier of a self-packet mode terminal. Although the reservation signal is made into the control signal for exclusive use different from a packet, it is also possible by making a control signal share a packet to use the leading packets of a packet group as a reservation signal.

[0027]Since the packet group which the packet mode terminal 2 transmits consists of six packets, the packet mode terminal 2 sets Request-to-Send length to 6 in a reservation signal, and is demanding a part for six slots. The packet mode terminal 3 which the packet group which should transmit generated as well as the packet mode terminal 2 transmits a reservation signal by arbitrary going-up slots out of the slot which received the free line signal.

[0028]Since the packet group which the packet mode terminal 3 transmits at this time consists of three packets, the packet mode terminal 3 sets Request-to-Send length to 3 in a reservation signal, and is demanding a part for three slots. On the other hand, the base transceiver station 1 is the next frame of the frame which received the reservation signal, points to the transmission permission timing 1 within an enabling signal to the packet mode terminal 2, and gives a transmission permission while it changes a free line signal to an inhibiting signal and forbids the transmission from other packet mode terminals. To the packet mode terminal 3, into an enabling signal, it points to the transmission permission timing 7, and a transmission permission is given.

[0029]Here, the transmission permission timing k (k: natural number) shows the transmission permission from the k-th following going-up slot. An enabling signal contains the terminal identifier of the packet mode terminal which carries out a transmission permission. Although the enabling signal is made into the control signal for exclusive use other than an inhibiting signal in this embodiment, it is also possible to make both share and to consider it as the same signal. The

base transceiver station 1 calculates the total of the Request-to-Send length of a reservation signal who received simultaneously by one frame (this example of operation 9), and continues transmitting an inhibiting signal as a reservation period.

[0030]The packet mode terminal 2 starts transmission of a packet group from the 1st going-up slot after enabling signal reception. The packet mode terminal 3 starts transmission of a packet group from the 7th going-up slot after enabling signal reception. A base transceiver station changes an inhibiting signal to a free line signal after the end of a reservation period, and cancels prohibition of the transmission from other packet mode terminals.

[0031][A 2nd embodiment] The example (it corresponds to claim 3) of the scheduling type free line control access method in a 2nd embodiment of operation is shown in drawing 3. This embodiment gives a transmission permission preferentially to the packet mode terminal which transmitted the reservation signal which contains shorter Request-to-Send length among those reservation signals, when a base transceiver station receives two or more reservation signals in one frame.

[0032]Within one frame, the base transceiver station 1 compares the Request-to-Send length within the reservation signal received simultaneously, gives priority to him to the short packet mode terminal of Request-to-Send length, and gives a transmission permission. [two or more] In drawing 3, since the Request-to-Send length of the packet mode terminal 2 is [6 and the Request-to-Send length of the packet mode terminal 3] 3, transmission permission timing [as opposed to 1 and the packet mode terminal 2 in the transmission permission timing to the short packet mode terminal 3 of Request-to-Send length] is set to 4, and priority is given to transmission of the packet mode terminal 3.

[0033][A 3rd embodiment] The example (it corresponds to claim 2) of the scheduling type free line control access method in a 3rd embodiment of operation is shown in drawing 4 thru/or drawing 6. The case where the packet mode terminal 2 carries out an additional Request to Send during a reservation period is shown in drawing 4. First, in the same procedure as drawing 2, the base transceiver station 1 gives a transmission permission only to the packet mode terminal 2, and the packet mode terminal 2 starts transmission of a packet group. In the figure, since the Request to Send of the packet group of length 4 another slot arose during packet transfer, the packet mode terminal 2 performs the additional Request to Send for four slots as the Request-to-Send length 4 in the packet signal of a packet group transmitted previously. the base transceiver station 1 -- during a reservation period -- ** -- a sake -- the present -- an enabling signal is transmitted by making into transmission permission timing timing which a reservation

period ends (this example of operation 3). Thereby, the packet mode terminal 2 starts transmission of the following packet group from the 3rd going-up slot after enabling signal reception.

[0034]In this embodiment, the case where the packet mode terminal 2 carries out an additional Request to Send during the reservation period of the packet mode terminal 2 and the packet mode terminal 3 is shown in drawing 5. In the same procedure as drawing 2, the base transceiver station 1 gives a transmission permission to the packet mode terminal 2 and the packet mode terminal 3, and the packet mode terminal 2 starts transmission of a packet group. In the figure, since the Request to Send of the packet group of length 4 another slot arose during packet transfer, the packet mode terminal 2 performs the additional Request to Send for four slots as the Request-to-Send length 4 in the packet signal of a packet group transmitted previously. the base transceiver station 1 -- during a reservation period -- ** -- a sake -- the present -- an enabling signal is transmitted by making into transmission permission timing timing which a reservation period ends (this example of operation 6). Thereby, the packet mode terminal 2 starts transmission of the following packet group from the 6th going-up slot after enabling signal reception.

[0035]In this embodiment, the case where the packet mode terminal 2 carries out an additional Request to Send after the end of a reservation period is shown in drawing 6. In the same procedure as drawing 2, the base transceiver station 1 gives a transmission permission to the packet mode terminal 2, and the packet mode terminal 2 starts transmission of a packet group. The base transceiver station 1 changes an inhibiting signal to a free line signal after the end of a reservation period. Since the Request to Send of the packet group of length 4 another slot arose during packet transfer, in the packet signal of a packet group transmitted previously, the packet mode terminal 2 performs the additional Request to Send for four slots as the Request-to-Send length 4.

[0036]The packet mode terminal 3 which the packet group which should newly transmit generated transmits a reservation signal by arbitrary slots out of the slot which received the free line signal. Since the packet group which transmits at this time consists of three packets, in a reservation signal, it sets Request-to-Send length to 3, and is demanding a part for three slots. On the other hand, while the base transceiver station 1 changes a free line signal to an inhibiting signal and forbidding the transmission from other packet mode terminals, To the packet mode terminal 2, into an enabling signal, it points to the transmission permission timing 1, and a transmission permission is given, and to the packet mode terminal 3, into an enabling signal, it

points to the transmission permission timing 5, and a transmission permission is given.

[0037]The base transceiver station 1 calculates the total of the Request-to-Send length of a reservation signal and an additional Request to Send who received simultaneously by one frame (this example of operation 7), and continues transmitting an inhibiting signal as a reservation period. The packet mode terminal 2 starts transmission of the following packet group from the 1st going-up slot after enabling signal reception. The packet mode terminal 3 starts transmission of a packet group from the 5th going-up slot after enabling signal reception.

[0038][A 4th embodiment] The example (it corresponds to claim 4) of the scheduling type free line control access method in a 4th embodiment of operation is shown in drawing 7. This embodiment gives a transmission permission preferentially to each packet mode terminal which transmitted the reservation signal, when a base transceiver station receives the singular number or two or more reservation signals, and an additional Request to Send in one frame.

[0039]When a reservation signal and an additional Request to Send are simultaneously received within one frame, priority is given to the base transceiver station 1 to the packet mode terminal which transmitted the reservation signal, and it gives a transmission permission. In drawing 7, transmission permission timing [as opposed to 4 and the packet mode terminal 3 in the transmission permission timing to the packet mode terminal 2] is set to 1, and priority is given to transmission of the packet mode terminal 3.

[0040][A 5th embodiment] The example (it corresponds to claim 5) of the scheduling type free line control access method in a 5th embodiment of operation is shown in drawing 8. This embodiment gives a transmission permission preferentially to the packet mode terminal which transmitted the reservation signal which contains shorter Request-to-Send length among two or more received reservation signals, when a base transceiver station receives two or more reservation signals and additional Requests to Send in one frame.

[0041]When a reservation signal and an additional Request to Send are simultaneously received by one frame, priority is given to the base transceiver station 1 to the packet mode terminal which transmitted the reservation signal, and it gives a transmission permission. When two or more reservation signals are received, Request-to-Send length is compared, and priority is given to the short packet mode terminal of Request-to-Send length, and a transmission permission is given.

[0042]Since the Request-to-Send length of the packet mode terminal 3 who transmitted the reservation signal is [3 and the Request-to-Send length of the packet mode terminal 4] 2 in drawing 8, Transmission permission timing [as opposed to the packet mode terminal 2 of 3 and

an additional Request to Send in transmission permission timing / as opposed to 1 and the packet mode terminal 3 in the transmission permission timing to the short packet mode terminal 4 of Request-to-Send length] is set to 6, and, subsequently priority is given to transmission of the packet mode terminal 3 for transmission of the packet mode terminal 4.

[0043][A 6th embodiment] The example (it corresponds to claim 6) of the scheduling type free line control access method in a 6th embodiment of operation is shown in drawing 9. This embodiment enables it to correspond when the slot number currently used for packet channels when the circuit-switched call from a line switching terminal newly occurs, for example, while the base transceiver station was performing a packet mode terminal and packet communication needs to be changed.

[0044]First, in the same procedure as drawing 2, the base transceiver station 1 gives a transmission permission to the packet mode terminal 2 and the packet mode terminal 3, and the packet mode terminal 2 and the packet mode terminal 3 start transmission of a packet group. When the circuit-switched call from the line switching terminal 5 newly generates the base transceiver station 1, Assignment to the circuit-switched call of a slot is suspended during a reservation period, it changes the slot number of packet channels into three slots from the 1st slot to the 3rd slot after the end of a reservation period, and assigns a circuit-switched call to the 4th slot. And packet communication with each packet mode terminal is henceforth performed by the 3rd slot from the 1st slot, and line switching communication with the line switching terminal 5 is performed by the 4th slot.

[0045]Time to suspend the maximum of a reserved period, i.e., the communication start of a circuit-switched call, here shall be designed become a small value to a permission call connection time delay at the time of a system design, and a circuit-switched call does not carry out call loss by quota suspension.

[0046][A 7th embodiment] The example (it corresponds to claim 7) of the scheduling type free line control access method in a 7th embodiment of operation is shown in drawing 10. This embodiment enables it to change the slot number currently used for packet channels, while the base transceiver station is performing a packet mode terminal and packet communication, and it is made to change a slot number after the end of a reservation period of packet communication.

[0047]First, in the same procedure as drawing 2, the base transceiver station 1 gives a transmission permission to the packet mode terminal 2, and the packet mode terminal 2 starts transmission of a packet group. The base transceiver station 1 suspends assignment to the circuit-switched call of a slot during a reservation period, when a circuit-switched call newly

occurs. Since the Request to Send of the packet group of length 4 another slot arose during packet transfer, in the packet signal of a packet group transmitted previously, the packet mode terminal 2 performs the additional Request to Send for four slots as the Request-to-Send length 4.

[0048]the base transceiver station 1 -- slot assignment of a circuit-switched call -- under suspension -- ** -- a sake -- an enabling signal -- not transmitting . The packet mode terminal 2 shifts to resending operation in order not to receive an enabling signal. The base transceiver station 1 changes the slot number of packet channels into three slots from the 1st slot to the 3rd slot after the end of a reservation period, and assigns a circuit-switched call to the 4th slot. Henceforth, packet communication is performed by the 3rd slot from the 1st slot, and line switching communication is performed by the 4th slot.

[0049]Next, the operation flow of the base transceiver station 1 at the time of including the operation in each embodiment mentioned above is shown in drawing 11 thru/or drawing 13. First, the base transceiver station 1 reports a free line signal to each terminal (step Sa1), and judges whether subsequently the reservation signal or the additional Request to Send from each terminal was received (step Sa2). It is judged whether when a reservation signal or an additional Request to Send was not received next, the circuit-switched call occurred (step Sa3).

[0050]Here, when a circuit-switched call occurs, it is judged whether the number of multi slots currently used for packet communication was reduced (step Sa4), the slot of the part was assigned to the circuit-switched call (step Sa5), and the circuit-switched call was completed after ** (step Sa6). In step Sa3, when a circuit-switched call does not occur, it is judged whether the circuit-switched call was completed promptly.

[0051]In step Sa6, when a circuit-switched call is completed, it adds to the number of multi slots which is using the slot which was being used for the circuit-switched call for packet communication (step Sa7), and returns to step Sa1, and a free line signal is reported again. When the circuit-switched call is not completed, it returns to step Sa1 as it is, and a free line signal is reported again. And when a reservation signal or an additional Request to Send is received from a packet mode terminal in step Sa2, From the Request-to-Send length in a reservation signal or an additional Request to Send, calculate the transmission permission timing and the reservation period for every packet mode terminal, and After ** (step Sa8), The present gets down and a slot judges whether it is a thing corresponding to the slot which received the reservation signal or the additional Request to Send (step Sa9), When it is a corresponding slot, an enabling signal is transmitted (step Sa10), and an inhibiting signal is transmitted when it is not a corresponding slot (step Sa12).

[0052]Then, when it judges whether the circuit-switched call occurred (step Sa11) and a circuit-switched call does not occur, it is judged whether transmission of an enabling signal was completed (step Sa13). And when a circuit-switched call occurs during this reservation period, the slot allocation to a circuit-switched call is suspended, and a judgment of step Sa13 is made after ** (step Sa14).

[0053]In step Sa13, when transmission of an enabling signal is not completed, processing of Steps Sa9-Sa13 is repeated until it returns to step Sa9 and transmission of an enabling signal is completed henceforth. When it judges whether the circuit-switched call occurred on the other hand when transmission of an enabling signal was completed (step Sa15) and a circuit-switched call does not occur, it is judged whether next the additional Request to Send was received (step Sa16). When a circuit-switched call occurs, a judgment of step Sa16 is made after suspending a circuit-switched call (step Sa17).

[0054]When an additional Request to Send is received during a reservation period (the decision result of step Sa16 is Yes), When a circuit-switched call is not suspending (the decision result of step Sa18 is No) and it gives an additional transmission permission (the decision result of step Sa19 is Yes), From the Request-to-Send length in an additional Request to Send, calculate transmission permission timing and a reservation period and After ** (step Sa20), The present gets down, and an inhibiting signal is transmitted when it is not a slot which transmits an enabling signal (step Sa23) and corresponds when it is a slot to which a slot judges whether it is a thing corresponding to the slot which received the additional Request to Send (step Sa21), and is equivalent (step Sa22).

[0055]And when it judges whether the reservation period expired (step Sa24) and the reservation period has not expired, processing to Steps Sa15-Sa25 is repeated until it transmits an inhibiting signal (step Sa25) and a reservation period expires henceforth. When an additional Request to Send is not received during a reservation period by step Sa16 (a decision result is No), Or when it is a case (a decision result is No) where (decision result does not give an additional transmission permission by Yes) or step Sa19 when a circuit-switched call is suspending by step Sa18, step Sa24 is processed promptly.

[0056]If it is judged that the reservation period expired in step Sa24, the slot allocation of a circuit-switched call will judge that it is under suspension (step Sa26), In under suspension, the number of multi slots of packet channels is reduced, and it assigns a slot to ** (step Sa27) and a circuit-switched call (step Sa28). And after assigning a slot to a circuit-switched call, Or when the slot allocation of a circuit-switched call is not suspending [be / it], When it judges whether

the circuit-switched call was completed (step Sa29) and a circuit-switched call is completed, it adds to the multi slots which are using the slot which was being used for the circuit-switched call for packet communication (step Sa30), and returns to step Sa1, and a free line signal is reported again. On the other hand, when the circuit-switched call is not completed, it returns to step Sa1 promptly and a free line signal is reported again.

[0057]Processing [in / on drawing 11 - drawing 13 and / Steps Sa8-Sa10, Sa12, and Sa13], It corresponds to the characterizing portion in the scheduling type free line control access method according to claim 1, The processing in Steps Sa8-Sa10, Sa12, Sa13 and step Sa16, Sa19 - Sa23 corresponds to the characterizing portion in the scheduling type free line control access method according to claim 2.

[0058]Especially processing of step Sa8 corresponds to the characterizing portion in the scheduling type free line control access method given in claims 3 thru/or 5, and processing of step Sa20 corresponds to the characterizing portion in the scheduling type free line control access method given in claims 4 and 5.

[0059]The processing in step Sa14, Sa17, Sa26 - Sa30, Corresponding to the characterizing portion in the scheduling type free line control access method according to claim 6, the processing in step Sa18 corresponds to the characterizing portion in the scheduling type free line control access method according to claim 7.

[0060]Next, the operation flow of each packet mode terminal in each embodiment mentioned above is shown in drawing 14 and drawing 15. First, when it judges whether the transmitting packet produced the packet mode terminal (step Sb1) and a transmitting packet arises, it is judged whether Request-to-Send length was calculated and the free line signal was received after ** (step Sb2) (step Sb3).

[0061]If a free line signal is received, arbitrary going-up slots will be chosen out of a slot, and a reservation signal (step Sb4) will be transmitted (step Sb5). And when it judges whether it got down and the enabling signal was received by the slot corresponding to the slot which transmitted the reservation signal (step Sb6) and an enabling signal is not received, random time standby is carried out and it returns to step (step Sb7) Sa3. When it receives, it stands by till the transmission permission timing within an enabling signal, and after ** (step Sb8), transmitting BAFFAHE transmission of the transmitting packet is carried out, and a packet signal is transmitted (step Sb9).

[0062]Next, when it judges whether the additional transmitting packet arose (step Sb10) and does not produce, A packet signal is transmitted and it judges whether a transmission buffer is

empty after ** (step Sb11) (step Sb12), when it is not empty, it returns to step Sb10, and when it is empty, it returns to step Sb1. On the other hand, in step Sb10, when an additional transmitting packet arises, the Request-to-Send length who adds is calculated (step Sb13), and an additional Request to Send is given to a packet signal, and it transmits (step Sb15). (step Sb14)

[0063]Then, when judging whether it got down and became the timing of the slot corresponding to the slot which transmitted the additional Request to Send (step Sb16) and not having become the timing, By judging whether the transmission buffer became empty, when ** (step Sb17) and a transmission buffer are empty, When [corresponding to the slot which returned to step Sb16 and transmitted the additional Request to Send] it stands by until it gets down and becomes the timing of a slot, and a transmission buffer is not empty, it returns to step Sb15 and a packet signal is transmitted succeedingly.

[0064]On the other hand, in step Sb16, if it judges whether the enabling signal was received (step Sb18) and an enabling signal is not received when [corresponding to the slot which transmitted the additional Request to Send] it gets down and becomes the timing of a slot, it progresses to step Sb12. When judging whether it became the transmission permission timing within an enabling signal when an enabling signal was received (step Sb19) and not having become transmission permission timing, By judging whether the transmission buffer became empty, when ** (step Sb20) and a transmission buffer are empty, It returns to step Sb19, it stands by until it becomes transmission permission timing, and when a transmission buffer is not empty, a packet signal is transmitted succeedingly and it returns to step Sb19 after ** (step Sb21).

[0065]And if it becomes transmission permission timing, an additional transmitting packet is transmitted to a transmission buffer, and it progresses to step Sb12 after ** (step Sb22), and when a transmission buffer is not empty, it will return to step Sb10, and a packet signal will be transmitted succeedingly. When it is empty, it returns to step Sb1, and operation mentioned above is performed from the beginning.

[0066]Processing [in / on drawing 14 and drawing 15 and / especially / step Sb8], Corresponding [and] to the characterizing portion in the scheduling type free line control access method according to claim 1, the processing in step Sb10, Sb13 - Sb22 corresponds to the characterizing portion in the scheduling type free line control access method according to claim 2.

[0067]

[Effect of the Invention]As opposed to the singular number which transmitted said reservation

signal according to the invention according to claim 1 as explained above, or said two or more packet mode terminals, Transmit said enabling signal which gave respectively individual transmission permission timing, and the period of the total of said Request-to-Send length within the singular number or said two or more reservation signals is made into a reservation period, Continue transmitting said inhibiting signal, and said packet mode terminal transmits with said transmission permission timing of the local station directed within said enabling signal one by one as the starting point, and said 1st packet group said base transceiver station, Since said inhibiting signal is changed to said free line signal after said reservation period expires, When a base transceiver station receives two or more reservation signals within one frame, by adjusting transmission permission timing for every packet mode terminal, It is possible to give a transmission permission to all the packet mode terminals which received the reservation signal, generating of the time delay resulting from packet resending and a collision is prevented, and the effect which makes channel utilization efficiency high is acquired.

[0068]Under the conditions which give an additional transmission permission according to the invention according to claim 2, and in during said reservation period, Give said transmission permission timing to said enabling signal, transmit to the packet mode terminal concerned, and the length of said 2nd packet group is added at said reservation period, Continue transmission of said inhibiting signal and said packet mode terminal starts transmission of said 2nd packet group with said transmission permission timing as the starting point within said enabling signal, Said base transceiver station changes said inhibiting signal to said free line signal, after said reservation period expires, When an additional transmission permission is given and said reservation signal or said additional Request to Send is not received to others under the conditions which are not said reservation period Naka, Give transmission permission timing to said enabling signal, transmit to the packet mode terminal concerned, and the length of said 2nd packet group is made into said reservation period, Continue transmitting said inhibiting signal, and said packet mode terminal begins with said transmission permission timing as the starting point within said enabling signal, and transmission of said 2nd packet group said base transceiver station, When said inhibiting signal is changed to said free line signal, and an additional transmission permission is given and said reservation signal or said additional Request to Send is received to others under the conditions which are not said reservation period Naka after said reservation period expired, Said enabling signal which gave said transmission permission each of said packet mode terminal timing set up individually, respectively is transmitted, The period of the total of the length of said 1st packet group within said reservation

signal and the length of said 2nd packet group in said additional Request to Send is made into a reservation period, Continue transmitting said inhibiting signal and said each packet mode terminal starts transmission of said 1st packet group or the 2nd packet group with said transmission permission timing as the starting point within said enabling signal, Since said base transceiver station changes said inhibiting signal to said free line signal after said reservation period expires, Even when an additional Request to Send and a reservation signal are received within one frame, a base transceiver station by adjusting transmission permission timing for every packet mode terminal, It is possible to give a transmission permission to all the packet mode terminals which received the reservation signal and the additional Request to Send, generating of the time delay resulting from packet resending and a collision is prevented, and the effect which makes channel utilization efficiency high is acquired.

[0069]According to the invention according to claim 3, said base transceiver station, When two or more reservation signals are received within one frame, the length of said 1st packet group within said each reservation signal is compared, Since said transmission permission timing is set up give priority over said packet mode terminal with the short length of said 1st packet group, and give a transmission permission, A packet mode terminal with a packet group with short length is able to prevent waiting for the sending end of a packet mode terminal with a packet group with long length, and the effect of decreasing the time delay of a packet is acquired.

[0070]Rather than said packet mode terminal in which said base transceiver station transmitted the additional Request to Send according to the invention according to claim 4. Since said transmission permission timing is set up give priority over said packet mode terminal which transmitted said reservation signal, and give a transmission permission, When a packet mode terminal continues by an additional Request to Send and transmits a packet signal, other packet mode terminals which the transmitting packet newly produced are able to have priority and transmit, and the effect that a time delay becomes equal with each packet mode terminal is acquired.

[0071]Rather than said packet mode terminal in which said base transceiver station transmitted the additional Request to Send according to the invention according to claim 5. Give priority to said packet mode terminal which transmitted said reservation signal, and the length of said 1st packet group within said each reservation signal is compared, Since said transmission permission timing is set up give priority to said packet mode terminal with the short length of said 1st packet group, and give a transmission permission, The effect that it is possible to consider it as the packet mode terminal in which the priority of transmission has the 1st packet

group with short length from a higher rank, a packet mode terminal with the 1st packet group with long length, and the packet mode terminal of an additional Request to Send, and the time delay of a packet is decreased, and a time delay becomes equal with each packet mode terminal is acquired.

[0072]Since change is suspended during said reservation period and a change after the end of said reservation period is made when said base transceiver station needs to change the slot number currently used for said packet channels according to the invention according to claim 6, When change arises in the slot number of packet channels and a packet mode terminal is during packet transmission, It is possible to change the number of after [the completion of transmitting] packet channels, without interrupting transmission of a packet group, and the effect of preventing decline in the channel efficiency resulting from resending of a packet group is acquired.

[0073]When said base transceiver station needs to change the slot number currently used for said packet channels according to the invention according to claim 7, Since a change after the end of said reservation period is made without permitting transmission when change is suspended during said reservation period and said additional Request to Send is received, When change arises in the slot number of packet channels and there is a packet mode terminal in the middle of transmitting [of a packet group], it is possible to change the number of packet channels, without interrupting packet transmission, and the effect of preventing decline in the channel efficiency resulting from resending of a packet group is acquired. The effect of suppressing the increase in holding time is acquired by performing change of the slot number of packet channels, without permitting this at the time of an additional Request to Send.

[0074]As mentioned above, as explained in detail, when the reservation signal from two or more packet mode terminals is received within one frame according to this invention, When a base transceiver station adjusts transmission permission timing and directs to each packet mode terminal individually, channel utilization efficiency becomes possible [providing a high scheduling type free line control access method with few time delays].

[0075]When an additional Request to Send and a reservation signal are received within one frame, and a base transceiver station adjusts transmission permission timing and directs to each packet mode terminal individually, channel utilization efficiency becomes possible [providing a high scheduling type free line control access method with few time delays]. When resending by a packet group unit, it becomes possible by preventing the transmission interruption of a packet group to provide the scheduling type free line control access method which can be changed

dynamically about the number of multi slots, without deteriorating channel utilization efficiency.

2.**** shows the word which can not be translated.

3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]It is a figure showing the composition of the wireless packet communication in the embodiment of this invention.

[Drawing 2]It is a figure showing the example of the scheduling type free line control access method in a 1st embodiment of this invention of operation.

[Drawing 3]It is a figure showing the example of the scheduling type free line control access method in a 2nd embodiment of this invention of operation.

[Drawing 4]It is a figure showing the case where the packet mode terminal 2 carries out an additional Request to Send during a reservation period among the examples of the scheduling type free line control access method in a 3rd embodiment of this invention of operation.

[Drawing 5]It is a figure showing the case where the packet mode terminal 2 carries out an additional Request to Send during the reservation period of the packet mode terminal 2 and the packet mode terminal 3 among the examples of the scheduling type free line control access

method in a 3rd embodiment of this invention of operation.

[Drawing 6]It is a figure showing the case where a packet mode terminal carries out an additional Request to Send after the end of a reservation period among the examples of the scheduling type free line control access method in a 3rd embodiment of this invention of operation.

[Drawing 7]It is a figure showing the example of the scheduling type free line control access method in a 4th embodiment of this invention of operation.

[Drawing 8]It is a figure showing the example of the scheduling type free line control access method in a 5th embodiment of this invention of operation.

[Drawing 9]It is a figure showing the example of the scheduling type free line control access method in a 6th embodiment of this invention of operation.

[Drawing 10]It is a figure showing the example of the scheduling type free line control access method in a 7th embodiment of this invention of operation.

[Drawing 11]It is a figure showing the operation flow of the base transceiver station in the embodiment of this invention.

[Drawing 12]It is a figure showing the operation flow of the base transceiver station in the embodiment of this invention.

[Drawing 13]It is a figure showing the operation flow of the base transceiver station in the embodiment of this invention.

[Drawing 14]It is a figure showing the operation flow of the packet mode terminal in the embodiment of this invention.

[Drawing 15]It is a figure showing the operation flow of the packet mode terminal in the embodiment of this invention.

[Drawing 16]It is a figure showing the example of the method which extended ICMA-PE to multi-slots correspondence of 3 multiplex TDMA system of operation.

[Drawing 17]It is a figure showing the example of ICMA-BR of operation.

[Description of Notations]

1 Base transceiver station

2 - 4 packet mode terminal

5 Line switching terminal